



# Design Guide/Chipset for Personal SoundComm System IIa

## ADDG-815/AD20msp815

### FEATURES

- RAM-Based Programmable Digital Signal Processor Architecture Provides Functional Extensions Through Software Algorithms**
  - Euphonics EuSynth-1\* FM Parameter Compatible Music Synthesis**
  - Echo Sound Card Command Controller Algorithms**
  - Speech Compression—LTP-RPE, ADPCM**
  - EuSynth-2\* Wavetable Music Synthesis**
  - Prosonus Wavetable Samples**
  - Digicom SoftModem†**
  - Digital Answering Machine Algorithms**
  - Programmable Architecture Allows Future Algorithm Expansion**
- Application Compatibility**
  - Voyetra—Multimedia Sound Software**
  - Winfax, Eclipse, Procomm, Bitfax, Faxworks and Other Popular Fax and Data Modem Packages**
  - Ring Zero-Ring Central**
- Key System Hardware Features**
  - Based on Analog Devices' DSP-Based SoundComm™ Chipset**
  - Industry Standard Sound Card Compatible**
  - Microsoft‡ MPC Compatible**
  - Windows Sound System‡ Compatible**
  - Covox Sound Master MPU-401§**
  - Socket for Wave Table ROM Option**
  - Stereo Microphone Input**
  - Stereo Line In and Line Out Ports**
  - Onboard 2 Watt/Channel Stereo Speaker Amplifier (5 Watt/Channel Population Option)**
  - MIDI/Joystick Port**
  - Panasonic CD-ROM Interface**
  - Onboard DAA**
  - Handset Connection for Voice I/O**

\*EuSynth-1 and EuSynth-2 are trademarks of Euphonics.

†SoftModem is a trademark of Digicom Systems, Inc.

‡Microsoft is a registered trademark of Microsoft Corp. Windows Sound System is a trademark of Microsoft Corp.

§MPU-401 is a registered trademark of Roland.

SoundComm is a trademark of Analog Devices, Inc. SoundPort is a registered trademark of Analog Devices, Inc.

### GENERAL DESCRIPTION

The Personal SoundComm System IIa (PSCS IIa) is an ISA-bus card that supports high fidelity stereo audio, high speed modem functions, and telephone answering machine functions based on powerful, low cost ADSP-2100 family Digital Signal Processor (DSP) technology. It combines the Echo Personal Sound System, Digicom SoftModem, plus digital answering machine and telephony support.

#### ADDG-815 Design Guide

The ADDG-815 Design Guide provides all the key design information to productize the PSCS IIa. It includes the following:

- PSCS IIa Schematics
- PSCS IIa Bill of Materials
- PSCS IIa Board
- All Audio, Modem, and Answering Machine Algorithm and Driver Software
- Demo Version of Voyetra Multimedia Software
- Demo Version of Ring Zero Ring Central Software
- Demo Version of SofNet FaxWorks Software
- Hardware and Software Installation Instructions

The design guide permits a manufacturer to take the design, lay it out to meet its product and manufacturing requirements, and market and sell the card with supporting application software. All DSP algorithm software is licensed as part of the AD20msp815 chipset.

The remainder of the data sheet describes the hardware and software of the PSCS IIa.

### HARDWARE DESCRIPTION

The PSCS IIa combines many popular audio and telephone functions on a single ISA-bus card. Referring to the block diagram in Figure 1, the heart of the system is the ADSP-2101 digital signal processor which runs all its programs out of static RAM making it a general-purpose programmable system.

The DSP interfaces to the AD1848 SoundPort® and ESC614 ASIC which are the key integrated circuits from which the board's audio functions are provided. The board also provides hardware support for stereo audio I/O, a MIDI port, a game port, and a Panasonic CD-ROM interface. The optional ROM is for a wavetable synthesis look-up table and an additional stereo DAC is included for music synthesis.

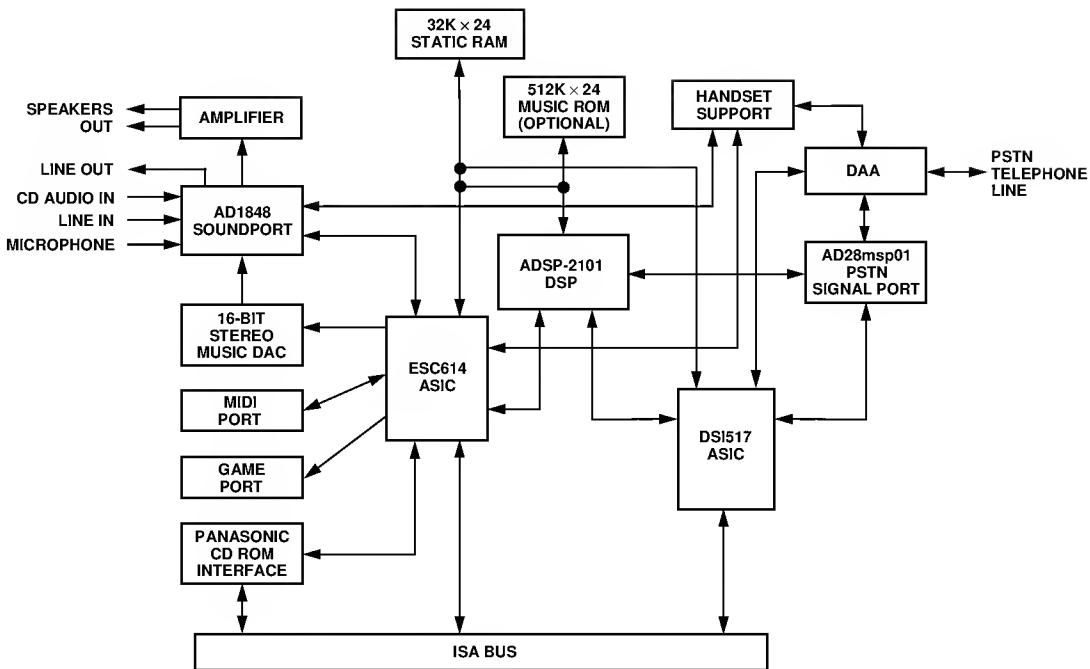
The DSP also interfaces to the modem subsystem through the AD28msp01 PSTN Signal Port and the DSI517 ASIC. The AD28msp01 performs high speed echo-cancelling modem-specific functions to off-load the DSP and is the signal interface to the phone line through the DAA circuit. The DSI517 is the ISA bus interface as well as performing DAA control functions.

REV. 0

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices.

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.  
Tel: 617/329-4700  
Fax: 617/326-8703

# ADDG-815/AD20msp815



*Figure 1. Personal SoundComm System IIa Hardware Block Diagram*

The system provides answering machine support using the DSP for voice compression to save hard disk space. Playback of messages can be accomplished through the speaker outputs provided as part of the audio subsystem or through a handset which the board supports. Similarly recording can be done with a microphone or a handset. The microphone and speaker can also be used as a speakerphone when using the system as a conventional voice telephone.

## AD20msp815 Chipset

Analog Devices ADSP-2100 family of powerful, low cost DSPs has made possible the marriage of high fidelity audio, high speed modem, and telephone answering functions on a single card. The AD20msp815 uses the programmable ADSP-2101 digital signal processor in a RAM-based design to perform all functions. This is the same DSP used cost effectively in the separate modem and audio products.

## AD20msp815A Chipset Contents

Model	Description
ADSP-2101KP-66	Low Cost, High Performance DSP in PLCC Package
AD1848KP	Industry Standard SoundPort in PLCC Package
AD28msp01KR	Signal Port for PSTN Communications in SOIC Package
ESC614-1	Audio ASIC in PQFP Package
DSI517X	Modem ASIC in PLCC Package

Bundled Software Licenses for Euphonics EuSynth-1 FM Parameter Compatible Music Synthesis, Echo Sound Card Command Controller Algorithms, and Digicom SoftModem Algorithms.

## CHIPSET IC FEATURE HIGHLIGHTS

### ADSP-2101

#### Complete DSP Microcomputer

2K Words of On-Chip Program Memory RAM

1K Words of On-Chip Data Memory RAM

60 ns Instruction Cycle Time from 16.67 MHz Crystal  
ADSP-2100 Family Code and Function Compatible

### AD1848 SoundPort

Single-Chip Integrated Sigma-Delta Digital Audio Stereo Codec

Supports the Microsoft Windows Sound System and PSA

Multiple Channels of Stereo Input and Output

Analog and Digital Signal Mixing

Programmable Gain and Attenuation

### AD28msp01 PSTN Communication Signal Port

Complete Analog I/O Port for DSP-Based Fax/Modem Applications

16-Bit Sigma-Delta ADC and DAC

Anti-Alias, Anti-Image, and Digital Resampling/Interpolation Filters

All Required Modem Sampling Rates and Bit and Baud Clock Generation

Independent Transmit and Receive Phase Adjustment

ESC614 and DSI517 Bus Interface ICs

## PC to DSP Interface

## 8-Bit Polled I/O

## 8-Bit DMA Transfers

## 16-Bit Polled I/O

### **Programmable IRQ and DMA**

#### **Industry Standard Sound Card and AdLib Compatible**

### Registers

## Registers AD1848 SoundPort Interface

### **Switch Between DSP and ISA Bus**

## **Windows Sound System Compatible Registers**

#### **Programmable Port Address, I/O, and DMA**

## Programmable CD-ROM Interface

## **Programmable Address Decoding for Panasonic Interface**

## Programmable IRQ

## MIDI Interface

Built-in MIDI UART Accessible by DSP

### **MPU-401 Compatible Registers**

### **Programmable Port Addresses and I/O**

### **Programmable Joystick Interface**

#### **Address Decoding to Support Standard PC Joystick**

## Memory Interface

### Address Decoding for 2<sup>10</sup> RAM

## Address Decoding External ROM

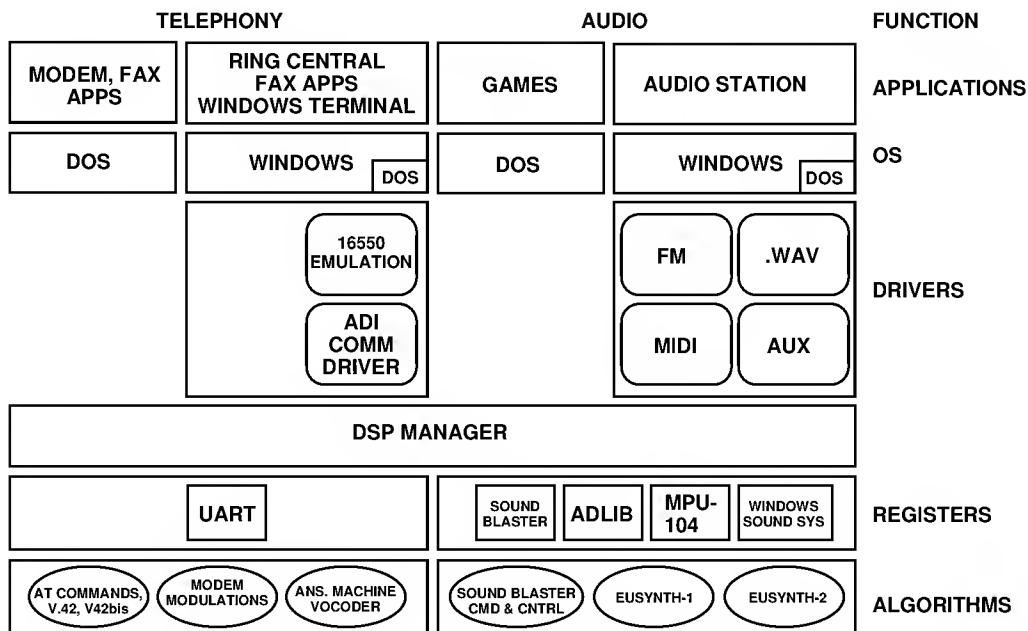
## ART Emulation

## **SOFTWARE GENERAL DESCRIPTION**

The PSCS IIa is one of a series of SoundComm architecture reference designs for multimedia and communications applications. The board supports a variety of algorithm and PC application software.

The audio portion of the PSCS IIa is based on the Echo Personal Sound System (PSS). The PSS was designed to provide industry standard sound card and Windows Sound System compatibility, and to exceed their performance and fidelity by leveraging the computational power of the DSP to provide real-time audio compression and decompression.

The telephony portion of the PSCS IIa is based upon the SoftModem from Digicom Systems, and answering machine and telephone software from Analog Devices and Ring Zero Systems. The modem provides industry standard data modem and fax transmission and reception. Because the SoftModem is based on a reprogrammable DSP, the addition of higher performance algorithms to increase transmission rates, error correction, etc., can be done via software, rather than hardware, upgrades. This reprogrammability not only extends the useful life of the modem but allows for quicker and easier upgrades and improvements. The addition of telephone, telephone automation, speakerphone, and answering machine makes the PSCS IIa a versatile communications appliance and shows the expandability of the DSP-based platform. Figure 2 shows a block diagram of the system's software.



*Figure 2. PSCS IIa Software Block Diagram*

# ADDG-815/AD20msp815

## AUDIO SOFTWARE

This section describes support of popular audio standards, Windows software, and DOS software.

## AUDIO STANDARDS

### Sound Blaster\*

The PSCS IIa is fully sound card compatible. The card provides complete audio support for virtually all games written for the Sound Blaster interface.

### AdLib

The PSCS IIa is AdLib compatible by virtue of its sound card compatibility. AdLib drivers have been enhanced to fully support switching back and forth between audio and telephony functions.

### Windows Sound System

The PSCS IIa is hardware and software compatible with the Windows Sound System. Hardware compatibility implies that the PSCS IIa provides the identical hardware options and register sets as the Windows Sound System card. When combined with music synthesis from Euphonics, the PSCS IIa is software compatible with the Windows Sound System card.

## WINDOWS AUDIO SOFTWARE

The PSCS IIa is compliant with the Microsoft Windows Multimedia Extensions. The Multimedia Extensions define mechanisms and protocols for applications and hardware to support multimedia under Windows. The extensions define software layers that isolate applications from hardware specifics and provide Application Programming Interfaces (APIs) that applications can use to invoke multimedia functions. A software layer, called the driver layer, turns these API calls into hardware specific commands in order to carry out the function invoked by the application. Thus, with the inclusion of the appropriate driver, the PSCS IIa will be compatible with all applications that adhere to the Multimedia Extensions.

### Applications

The PSCS IIa has been tested to ensure compatibility with the following applications from Voyetra Technologies:

- WinDAT—A digital audio (WAV) editor
- Jukebox—WAV/MIDI/CD playlist program
- AudioStation—WAV/MIDI/CD/Mixer control program
- MIDIOrchestrator—MIDI song file arranger
- SayIt!—OLE voice annotation program
- Audio Calendar—Multimedia scheduling program
- VoiceNet—Voice/text mail system for Novell LANs
- SoundScript—Multimedia presentation program
- SoundEvent—Adds WAV audio to Windows events

### Drivers

The driver software layer translates all application requested multimedia actions into hardware specific commands. The following drivers are provided with the PSCS IIa:

### Waveform

The WAV driver provides digital audio support. The driver provides 2-channel, stereo, 16-bit samples at sampling rates up to 48 kHz. The driver supports, as a minimum, the following formats in both input and output modes:

- PCM—uncompressed digital audio format suitable for voice and music
- LTP-RPE—a 13 kbps voice coder

### MIDI

The MIDI driver provides for the transfer of MIDI data to and from external MIDI devices. In addition, the MIDI driver provides the capability to use an onboard synthesizer to generate music from MIDI information. Music synthesis is accomplished by any of the following algorithms:

- Music Synthesis—from Euphonics, this algorithm provides basic music synthesis.
- Wave Table Synthesis—from Euphonics, this algorithm provides very high quality reproduction as the synthesis is based on actual sampled sounds from musical instruments. These samples are stored in a Read Only Memory (ROM) on the PSCS IIa board.

### AUX

The AUX driver provides for the control of the mixing of audio input and output sources. The AUX driver will also allow WAV playback and recording using the handset.

### CD-ROM

The CD-ROM drivers, the disk driver, and Microsoft CD-ROM extensions are normally supplied with the CD-ROM drive itself.

The PSCS IIa includes Wave, AUX and MIDI drivers from Voyetra. Windows Sound System drivers run without the Voyetra drivers on the PSCS IIa, although some features are not supported. Windows Sound System drivers must be removed in order to run software based on the Voyetra drivers and Windows Sound System drivers are used without the DSP manager.

### DOS SUPPORT

The PSCS IIa maintains sound card and AdLib compatibility under DOS. Sound card and AdLib compatibility may not work fully from a DOS shell within Windows.

## TELEPHONY SOFTWARE

This section describes the telephony software supported by the PSCS IIa.

Telephony applications communicate with the card via the serial communication ports (COM) of the PC. Most telephony applications in use today communicate with the telephony hardware via these COM ports using a software protocol based on the Hayes AT Command Set and extensions. This protocol defines a common set of functionality for data and fax modem functions, and is being extended to voice functions.

\*Sound Blaster is a registered trademark of Creative Technologies.

**Modem**

The card is tested to insure compatibility with the Terminal Emulator program supplied with Windows 3.1.

**FAX**

The card is tested to insure compatibility with the FaxWorks program from SofNet. The board will work with numerous other popular fax application packages also.

**Digital Telephone Answering Machine (DTAM)**

The card is tested to insure compatibility with Ring Central from Ring Zero Systems. This application supports advanced answering machine capabilities such as multiple mailboxes, multiple individualized greetings, and forwarding of messages.

**DOS Support**

Data and fax applications for DOS are supported under native DOS and under a DOS shell from Windows.

**DSP MANAGER**

Because the PSCS IIa is capable of performing a variety of functions, there is a need for a software module that resides on the host PC to provide overall control of the DSP subsystem. This software, called the DSP Manager, is provided by Analog Devices.

The DSP Manager automatically senses what functionality is required by the user. Once the DSP Manager has determined the required functionality, the DSP Manager identifies the algorithm that needs to be downloaded to the board. The DSP Manager then configures the hardware on the board, if required, and downloads the appropriate DSP algorithm.

The design description of the DSP Manager is available from Ring Zero Systems, Inc.

**SPECIFICATIONS****GENERAL****PC Requirements**

Industry Standard x386, x486-Based  
RAM—4 Mbyte Minimum, 8 Mbyte Recommended  
ISA Bus (Com 1-4)  
Windows Version 3.1 or 3.11

**TELEPHONY****Fax/Data Modem****Transmission Speeds**

1200, 2400, 4800, 7200, 9600, 12,000, 14,400 bps

**Modulation Standards**

V.22bis (2400/1200 bps)  
V.32 (9600/4800 bps)  
V.32bis (14400/12000/7200 bps)  
V.23 (1200 Tx/75 Rx or 75 Tx/1200 Rx)  
V.42bis Data Compression  
V.27ter (2400/4800 bps)  
V.29 (7200/9600 bps)  
V.17 (14400 bps)

**Error Correction/Data Compression**

CCITT V.42 and MNP 2  
V.42bis and MNP 5

**Flow Control**

XON/XOFF and RTS/CTS

**Operation**

Asynchronous Full Duplex Dial-Up, Tone or Pulse Dialing,  
and Auto-Answer Mode

**Commands**

Extended AT Command Set

**Command Buffer**

40 Characters

**Test Modes**

V.54 Analog, Digital and Remote Loopback with Self-Test

**Tones Detected**

Dial Tone, Busy, Ring Back and Modem Answering Tones

**Digital Telephone Answering Machine****Compression**

13 kbps LTP- RPE

**Record**

Through Microphone, Speakerphone, or Handset  
5 Mailboxes  
Individualized Greetings

**Playback**

Message Forwarding  
Through Speakers or Handset

**Telephone****Handset Support**

Speaker Phone with Microphone and Speakers  
Automated Dialing

# **ADDG-815/AD20msp815**

## **AUDIO**

### Sample Rates

11.025, 22.050, 44.100 and 48 kHz

### Coding Formats

8-Bit PCM, 16-Bit PCM, A-law,  $\mu$ -law

### Mixing

Microphone, WAV, Line, /CD, Synthesis

### Power Amp

2 Watts/Channel or 5 Watts/Channel

### Ports

Joystick/MIDI

Microphone In

Line In

Line Out

Speaker Out

MIDI Cable Adapter

### CD ROM Interface

Panasonic

### Music Synthesis

EuSynth-1 11 Voice

EuSynth-2 Wavetable Upgrade by ROM

### Compatibility

Windows Sound System

Industry Standard Sound Card

Ad Lib

Microsoft MPC

MIDI MPU-401